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HARNESS, DICKEY & PIERCE, P.L.C.
P.O.BOX 8910
RESTON, VA 20195

EXAMINER	
CORBETT, JOHN M	

ART UNIT	PAPER NUMBER
2882	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dcmailroom@hdp.com
siemensgroup@hdp.com
pshaddin@hdp.com

Office Action Summary	Application No.	Applicant(s)	
	10/667,475	BRUDER ET AL.	
	Examiner	Art Unit	
	JOHN M. CORBETT	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 September 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-6,11,12 and 14-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-6,11,12 and 14-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *28 September 2009*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 11 July 2008 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The German office actions dated 8 July 2003 and 11 June 2008 are neither in English, nor have English translations provided for, nor have a concise statement of relevance and therefore have not been considered. Simply checking box in section III. B. 1. is insufficient since office actions are not in English and are not in a format in which the Examiner can extract potentially relevant information contained therein. As noted in attached information disclosure statement, DE 197 11 693 has been considered in accordance with section III. B. 3.

Claim Objections

2. Claim 16 is a substantial duplicate of claim 3, and is objected to under 37 CFR 1.75. See MPEP § 706.03(k).

3. Claims 21-22 and 24 are objected to for failing to set forth the structure with which the apparatus/device is comprised.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 3-6, 12, 14-19, 21-22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Tuy (US 6,104,775) which incorporates by reference Tuy (US 6,097,784).

With respect to claim 1, Tuy (‘775) discloses a method of creating images in computed tomography (Title and Abstract), comprising:

rotating at least one focus (20), to scan an object under examination with a beam originating from the at least one focus (Figure 1), relative to the object on at least one focal path running around the object, wherein a detector array (40) including a plurality of distributed detector elements arranged in rows and lines and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination (Figure 1);

filtering the initial data (54), wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (52), and the filtering is carried out in

a direction of a tangent to the at least one focal path belonging to the respective focal position (Abstract and Figure 1);

backprojecting (58) the filtered initial data (Figure 1), three-dimensionally (Abstract), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object (Slices produced), wherein, during the backprojection, the rays are weighted (56 and Figure 1) as a function of corresponding position in the beam with a weighting function (Col. 2, lines 42-48 and Col. 8, lines 12 -13, multiplicity function which is introduced to account for redundancy in the collected data. Also see patent application number 09/164,013 corresponding to US patent number 6,097,784, hence referred to as Tuy ('784), where multiplicity function has terms corresponding to relative level to the point of reconstruction, i.e. cone angle in beam) representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Col. 14, lines 44-64 and claim 9 of Tuy ('784) where weight of 1 applied when vertex, source point, is at same level as reconstruction point and goes to zero as vertex rotates helically. So when cone angle zero, point to reconstruct at center of detector and weight is one. As source rotates, cone angle increases and weight goes to zero gradually, hence a smooth function.).

With respect to claim 3, Tuy ('775) further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation (22, cone-shaped beam), and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of

the axis of rotation, are weighted to a relatively greater extent than the rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Col. 14, lines 44-64 and claim 9 of Tuy ('784)).

With respect to claim 4, Tuy ('775) further discloses the rebinning includes,

converting, before filtering, the initial data obtained in fan beam geometry in the form of rays P(α,β, q) into parallel data present in parallel beam geometry in the form of rays P(θ, β, q) or P(θ, p, q), where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

θ = α + β is the parallel fan angle,

p = $R_F$sin (β) is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Abstract, parallel rebinning).

With respect to claim 5, Tuy ('775) further discloses the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each $\theta \in [0,\pi]$ for the rays P(θ +kπ, $\tilde{\beta}$, q) and P(θ +kπ, $\tilde{p}$, q) whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\theta) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)$$

is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{p}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

β are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Abstract, Col. 10, line 54 - Col. 11, line 39, Claim 1 and Figure 1).

With respect to claim 6, Tuy ('775) further discloses during the backprojection of the parallel data, the sum

$$H = \sum_{k} \sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right)$$

normalized to the sum H of the weights h

$$P_{x,y,z}(\theta) = \frac{1}{H}\sum_{k}\sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \beta \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \beta \\ \tilde{\beta} \end{Bmatrix}, q\right)$$

is formed (Col. 8, lines 12-47 of Tuy ('775) and Col. 7, lines 35-54 of Tuy (‘784)).

With respect to claim 12, Tuy (‘775) further discloses the focal path is a spiral path which is brought about by the focus being moved about the system axis on a circular path and, at the same time, a relative movement between focus and object under examination in the direction of the system axis taking place (Title, helical scanning).

With respect to claim 14, Tuy (‘775) further discloses a Computed Tomography (CT) device for scanning an object under examination (Figure 1), comprising:

means for scanning the object (Figure 1), including at least one focus (20) from which a beam originates;

a detector array (40) including a plurality of distributed detector elements arranged in rows and lines, wherein the at least one focus is movable relative to the object on at least one focal path running around the object and wherein the detector array is adapted to supply detected data representing an attenuation of the rays passing through the object (Figure 1), the detected data configured to be obtained in fan beam geometry and rebinned into parallel beam geometry (52);

means for filtering the detected data (54), the means for filtering being configured to carryout filtering in a direction of a tangent to the at least one focal path belonging to the respective focal position (Abstract and Figure 1);

means for backprojecting (58) the filtered data (Figure 1), three-dimensionally (Abstract), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer (Slices produced), wherein, during the backprojection, the rays are weighted (56 and Figure 1) as a function of corresponding position in the beam with a weighting function (Col. 2, lines 42-48 and Col. 8, lines 12 -13, multiplicity function which is introduced to account for redundancy in the collected data. Also see patent application number 09/164,013 corresponding to US patent number 6,097,784, hence referred to as Tuy ('784), where multiplicity function has terms corresponding to relative level to the point of reconstruction, i.e. cone angle in beam) representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Col. 14, lines 44-64 and claim 9 of Tuy ('784) where weight of 1 applied when vertex, source point, is at same level as reconstruction point and goes to zero as vertex rotates helically. So when cone angle zero, point to reconstruct at center of detector and weight is one. As source rotates, cone angle increases and weight goes to zero gradually, hence a smooth function.); and

means for collecting the data (Figure 1).

With respect to claim 15, Tuy ('775) further discloses at least one of the means for scanning, the means for filtering and the means for backprojecting is at least partly implemented by at least one of programs and program modules (Figure 1, computations performed on computer which is necessarily programmed).

With respect to claim 16, Tuy (‘775) further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation (20, cone beam), and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation, are weighted to a relatively greater extent than the rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Col. 14, lines 44-64 and claim 9 of Tuy (‘784)).

With respect to claim 17, Tuy (‘775) further discloses the weighting function represents a function of the parallel fan angle with $W(\theta + k\pi)$ (Col. 2, lines 17-24, Col. 5, line 65 – Col. 8, line 3).

With respect to claim 18, Tuy (‘775) further discloses the detector array includes detector elements arranged in the manner of rows (Col.4, lines 17-51 and Figure 1), and the weighting function represents a function of the row number W(q) (Col. 14, lines 44-64 and claim 9 of Tuy (‘784) where weight of 1 applied when vertex, source point, is at same level as reconstruction point and goes to zero as vertex rotates helically. So when cone angle zero, point to reconstruct at center of detector and weight is one. As source rotates, cone angle increases and weight goes to zero gradually, hence a smooth function. Increasing cone beam angle corresponds to increase in detector row number so that weight is a function of row number.);

With respect to claim 19, Tuy ('775) further discloses the detector elements on the detector array are arranged distributed in the manner of a matrix (Col.4, lines 17-51 and Figure 1. detectors arranged in a manner of a matrix.).

With respect to claim 21, Tuy ('775) further discloses an apparatus operable to perform the method of claim 1 (Figure 1).

With respect to claim 22, Tuy ('775) further discloses the apparatus includes a Computed Tomography (CT) scanner (Figure 1).

With respect to claim 24, Tuy ('775) further discloses a Computed Tomography (CT) device operable to perform the method of claim 1 (Figure 1).

5. Claims 1, 3-6, 11, 14-16, 18-19, 21-22 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Pan et al. (US 7,245,755 B1).

With respect to claim 1, Pan et al. discloses a method of creating images in computed tomography (Title and Abstract), comprising:

rotating at least one focus (Col. 23, line 25 and Claim 4, circular and helical scans respectively), to scan an object under examination with a beam originating from the at least one focus, relative to the object on at least one focal path running around the object, wherein a detector array including a plurality of distributed detector elements arranged in rows and lines

and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination (Figure 3 and 18);

filtering the initial data (Col. 23, line 27, filtered backprojection), wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (Col. 23, lines 42-48), and the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position (for circular trajectory, filter direction is along row direction, i.e. tangent to circle);

backprojecting the filtered initial data, three-dimensionally (Col. 23, lines 35-42), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object (Col. 23, lines 35-42, slices produced), wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Equations 11 and 12, $\cos\gamma$ is smooth function).

With respect to claim 3, Pan et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation, and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation (Abstract, cone-beam), are weighted to a relatively greater extent than the rays arranged close to

the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Equations 11 and 12, cosγ).

With respect to claim 4, Pan et al. further discloses the rebinning includes,

converting, before filtering, the initial data obtained in fan beam geometry in the form of rays $P(\alpha,\beta, q)$ into parallel data present in parallel beam geometry in the form of rays $P(\theta, \beta, q)$ or $P(\theta, p, q)$, where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

$\theta = \alpha + \beta$ is the parallel fan angle,

$p = R_F \sin(\beta)$ is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Col. 23, lines 39-64 and Col. 24, line 46 – Col. 26, line 64 and Figure 18).

With respect to claim 5, Pan et al further discloses the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each θ.epsilon.[o,π] for the rays $P(\theta + k\pi, \tilde{\beta}, q)$ and $P(\theta + k\pi, \tilde{p}, q)$ whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\tilde{\theta}) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix}\tilde{p} \\ \tilde{\beta}\end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix}\tilde{p} \\ \tilde{\beta}\end{Bmatrix}, q\right)$$

is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{P}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

β are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Col. 23, lines 39-64, Col. 24, line 46 – Col. 26, line 64, equations 11-12 and Figure 18).

With respect to claim 11, Pan et al. further discloses the focal path is a circular path (Col. 23, line 25 and Figure 18).

With respect to claim 14, Pan et al. discloses a Computed Tomography (CT) device for scanning an object under examination (Title, Abstract and Figure 3), comprising:

means for scanning the object, including at least one focus from which a beam originates (Col. 23, line 25 and Claim 4, circular and helical scans respectively. Also, Figure 3, CT systems scan);

a detector array including a plurality of distributed detector elements arranged in rows and lines (Figure 3, CT systems have array detectors to detect cone beams), wherein the at least one focus is movable relative to the object on at least one focal path running around the object and wherein the detector array is adapted to supply detected data representing an attenuation of the rays passing through the object, the detected data configured to be obtained in fan beam geometry (Col. 23, line 25 and Claim 4, circular and helical scans respectively) and rebinned into parallel beam geometry (Col. 23, lines 42-48);

means for filtering the detected data, the means for filtering being configured to carryout filtering in a direction of a tangent to the at least one focal path belonging to the respective focal position (for circular trajectory, filter direction is along row direction, i.e. tangent to circle);

means for backprojecting the filtered data, three-dimensionally, to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer (Col. 23, lines 35-42, slices produced), wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Equations 11 and 12, $\cos\gamma$ is smooth function); and

means for collecting the data (CT systems necessarily have means for collecting the data).

With respect to claim 15, Pan et al. further discloses at least one of the means for scanning (Title, Abstract and Figure 3, CT systems necessarily have scanning means to acquire data), the means for filtering and the means for backprojecting is at least partly implemented by at least one of programs and program modules (Algorithm necessarily performed on computer. Also see claim 21).

With respect to claim 16, Pan et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation, and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation (Abstract, cone-beam), are weighted to a relatively greater extent than the rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Equations 11 and 12, $\cos\gamma$).

With respect to claim 18, Pan et al. further discloses the detector array includes detector elements arranged in the manner of rows (Figure 3 and 18), and the weighting function represents a function of the row number W(q) (Equations 11 and 12, $\cos\gamma$).

With respect to claim 19, Pan et al. further discloses the detector elements on the detector array are arranged distributed in the manner of a matrix (Figure 3 and 18).

With respect to claim 21, Pan et al. further discloses an apparatus operable to perform the method of claim 1 (Abstract, Figures 1-3 and claim 20).

With respect to claim 22, Pan et al. further discloses the apparatus includes a Computed Tomography (CT) scanner (Title, Abstract, Figures 1-3 and claim 20).

With respect to claim 24, Pan et al. further discloses a Computed Tomography (CT) device operable to perform the method of claim 1 (Abstract, Figures 1-3 and claim 20).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tuy (‘775) as applied to claim 1 above, and further in view of Hsieh (6,529,575).

With respect to claim 20, Tuy (‘775) discloses the method as recited above.

Tuy (‘775) fails to explicitly disclose a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method.

Hsieh teaches a computer-readable medium comprising computer executable instructions

configured to cause a computer to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Tuy (‘775) to include the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

With respect to claim 23, Tuy (‘775) discloses the method as recited above.

Tuy (‘775) fails to explicitly disclose a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform the method.

Hsieh teaches a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform the method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Tuy (‘775) to include the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

7. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al. as applied to claim 5 in view of Bruder et al. (“Performance of Approximate cone-beam

reconstruction in multi-slice computed tomography", 2000, SPIE, Volume 3979, Pages 541-553).

With respect to claim 6, Pan et al. discloses the method as recited above.

Pan et al. fails to disclose during the backprojection of the parallel data, the normalized weights and normalized projections are formed.

Bruder et al. discloses during the backprojection of the parallel data, the normalized weights and normalized projections are formed (Equations 2 and 3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Pan et al. as modified above the normalizing of Proksa et al., since person would have been motivated to make such a modification to improve imaging by appropriately considering the contribution of each ray of each projection makes to the backprojection (Page 543, lines 29-30) as implied by Bruder et al.

With respect to claim 17, Pan et al. further discloses the weighting function represents a function of the parallel fan angle with $W(\theta + k\pi)$ (Col. 23, lines 42-48 and Figure 18).

8. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al. as applied to claim 1 in view in view of Sourbelle ("Performance Evaluation of Exact and Approximate Cone-beam Algorithms in Spiral Computed Tomography", 25 March, 2002, Erlangen University, Dissertation).

With respect to claim 12, Pan et al. further discloses the focal path is a spiral path which is brought about by the focus being moved about the system axis on a circular path and, at the same time, a relative movement between focus and object under examination in the direction of the system axis taking place (Claim 4, helical scan).

Pan et al. fails to explicitly disclose the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position for a helical scan.

Sourbelle performing the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position for a helical scan (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Pan et al. to include the spiral tangent filtering of Sourbelle, since a person would have been motivated to imaging by improving image quality (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1) as taught by Sourbelle.

9. Claims 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al. as applied to claim 1 above, and further in view of Hsieh (6,529,575).

With respect to claim 20, Pan et al. discloses the method as recited above.

Pan et al. fails to explicitly disclose a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method.

Hsieh teaches a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Pan et al. to include the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

With respect to claim 23, Pan et al. discloses the method as recited above.

Pan et al. fails to explicitly disclose a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform the method.

Hsieh teaches a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform the method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Pan et al. to include the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

10. Claims 1, 3-5, 14-16, 18-19, 21-22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Proksa et al. (US 6,285,733 B1) in view of Grass et al. ("3D Cone-beam CT Reconstruction for Circular Trajectories", 2000, Physics in Medicine and Biology, Volume 45, Pages 329-347).

With respect to claim 1, Proksa et al. discloses a method of creating images in computed tomography (Title and Abstract), comprising:

rotating at least one focus (Figure 1), to scan an object under examination with a beam originating from the at least one focus, relative to the object on at least one focal path running around the object (Figure 1), wherein a detector array (16) including a plurality of distributed detector elements arranged in rows and lines and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination (Figure 1);

filtering the initial data, wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (Col. 5, lines 20-25), and the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position (Abstract, Col. 2, lines 4-6, Col. 5, lines 9-15, Col. 6, lines 36-55, Col. 7, lines 1-14 and Figures 3-5. Filtering performed in row of rebinned rectangular virtual detector which is a direction tangent to circular focal path);

backprojecting the filtered initial data, three-dimensionally (Col. 2, lines 7-8 and 37-38), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object (Col. 2, lines 7-8 and 37-38).

Proksa et al. fails to explicitly disclose wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one

for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows.

Grass et al. teaches wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Equations 6-7 and Figure 3. $\text{Cos}(\theta) = l_s/l_p$ is equal to 1 (when $l_s = l_p$ for central row and $\text{Cos}(\theta)= l_s/l_p$ is a function that is smoothly tending to zero as detector row approached edge of detector).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Proksa et al. to include the reconstruction of Grass et al., since person would have been motivated to make such a modification to improve imaging by compensating for different path lengths through the volume (Page 333, lines 25-27), reducing computational complexity (Pages 333, lines 20-21) and reducing low-intensity drop (Page 338, lines 11-12) as taught by Grass et al.

With respect to claim 3, Proksa et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation (Abstract and Figure 1-5).

Grass et al. further teaches arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation, are weighted to a relatively greater extent than the

rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Equation 7 and Figure 3).

With respect to claim 4, Grass et al. further teaches wherein the rebinning includes,

converting, before filtering, the initial data obtained in fan beam geometry in the form of rays P(α,β, q) into parallel data present in parallel beam geometry in the form of rays P(θ, β, q) or P(θ, p, q), where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

θ = α + β is the parallel fan angle,

p = $R_F$sin (β) is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Pages 330-334, Section 2. The T_FDK method and Figures 1-3).

With respect to claim 5, Grass et al. further teaches wherein the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each θ.epsilon.[o,π] for the rays P(θ +kπ, $\tilde{\beta}$, q) and P(θ +kπ, $\tilde{p}$, q) whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\theta) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)$$

is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{P}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Equations 6-7).

With respect to claim 11, Proksa et al. further discloses the focal path is a circular path (17).

With respect to claim 14, Proksa et al. discloses a Computed Tomography (CT) device (Figure 1) for scanning an object (13) under examination, comprising:

means for scanning the object (1, 2, 5 and 7 and Figure 1), including at least one focus (S) from which a beam (4) originates (Figure 1);

a detector array (16) including a plurality of distributed detector elements (Figure 1) arranged in rows and lines, wherein the at least one focus is movable relative to the object on at least one focal path running around the object (Figure 1) and wherein the detector array is adapted to supply detected data representing an attenuation of the rays passing through the object (Figure 1), the detected data configured to be obtained in fan beam geometry and rebinned into parallel beam geometry (Col. 5, lines 20-25);

means for (10) filtering the detected data, the means for filtering being configured to carryout filtering in a direction of a tangent to the at least one focal path belonging to the respective focal position (Abstract, Col. 2, lines 4-6, Col. 5, lines 9-15, Col. 6, lines 36-55, Col. 7, lines 1-14 and Figures 3-5. Filtering performed in row of rebinned rectangular virtual detector which is a direction tangent to circular focal path);

means for (10) backprojecting the filtered data, three-dimensionally (Col. 2, lines 7-8 and 37-38), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer (Col. 2, lines 7-8 and 37-38); and

means for collecting the data (Figure 1).

Proksa et al. fails to explicitly disclose wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows.

Grass et al. teaches wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Equations 6-7 and Figure 3. $\text{Cos}(\theta) = l_s/l_p$ is equal to 1 (when $l_s = l_p$ for central row and $\text{Cos}(\theta)= l_s/l_p$ is a function that is smoothly tending to zero as detector row approached edge of detector).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Proksa et al. to include the reconstruction of Grass et al., since person would have been motivated to make such a modification to improve imaging by compensating for different path lengths through the volume (Page 333, lines 25-27), reducing computational complexity (Pages 333, lines 20-21) and reducing low-intensity drop (Page 338, lines 11-12) as taught by Grass et al.

With respect to claim 15, Proksa et al. further discloses wherein at least one of the means for scanning, the means for filtering and the means for backprojecting is at least partly implemented by at least one of programs and program modules (Col. 4, lines 47-56).

With respect to claim 16, Proksa et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation (Abstract and Figures 1-5).

Grass et al. further teaches arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation, are weighted to a relatively greater extent than the rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation.

With respect to claim 18, Proksa et al. further discloses the detector array includes detector elements arranged in the manner of rows.

Grass et al. further teaches the weighting function represents a function of the row number W(q) (Equations 7 and Figure 3).

With respect to claim 19, Proksa et al. further discloses the detector elements on the detector array are arranged distributed in the manner of a matrix (Figure 1).

With respect to claim 21, Proksa et al. further discloses an apparatus operable to perform the method of claim 1 (Figure 1).

With respect to claim 22, Proksa et al. further discloses the apparatus includes a Computed Tomography (CT) scanner (Figure 1).

With respect to claim 24, Proksa et al. further discloses a Computed Tomography (CT) device operable to perform the method of claim 1 (Figure 1).

11. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Proksa et al. in view of Grass et al. as applied to claim 5 above, and further in view of Bruder et al.

With respect to claim 6, Proksa et al. as modified above suggests the method as recited above.

Proksa et al. fails to disclose during the backprojection of the parallel data, the normalized weights and normalized projections are formed.

Bruder et al. discloses during the backprojection of the parallel data, the normalized weights and normalized projections are formed (Equations 2 and 3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Proksa et al. as modified above the normalizing of Proksa et al., since person would have been motivated to make such a modification to improve imaging by appropriately considering the contribution of each ray of each projection makes to the backprojection (Page 543, lines 29-30) as implied by Bruder et al.

With respect to claim 17, Grass et al. further teaches the weighting function represents a function of the parallel fan angle with $W(\theta + k\pi)$ (Pages 330-334, Section 2. The T-FDK method and Figures 1-3).

12. Claims 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Proksa et al. in view of Grass et al. as applied to claim 1 above, and further in view of Hsieh.

With respect to claim 20, Proksa et al. as modified above suggests the method as recited above.

Proksa et al. fails to explicitly disclose a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method.

Hsieh teaches a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Proksa et al. as modified above the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

With respect to claim 23, Proksa et al. as modified above suggests the method as recited above.

Proksa et al. fails to explicitly disclose a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform a method.

Hsieh teaches a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to include in the method of Proksa et al. as modified above the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

13. Claims 1, 3-5, 12, 14-16, 18-19, 21-22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heuscher et al. (US 2004/0076265 A1) in view of Sourbelle.

With respect to claim 1, Heuscher et al. discloses a method of creating images in computed tomography (Title and Abstract), comprising:

rotating at least one focus, to scan an object under examination with a beam originating from the at least one focus, relative to the object on at least one focal path running around the object (helical scanning), wherein a detector array including a plurality of distributed detector elements arranged in rows and lines and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination (Figures 1 and 2);

filtering the initial data (Paragraph 40), wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (Paragraph 39);

backprojecting the filtered initial data, three-dimensionally (Abstract and Paragraph 50, wedge method used and voxels produced), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object, wherein, during the backprojection, the rays are weighted as a function of

corresponding position in the beam with a weighting function representing a smooth function of the row number (Slices produced), the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Paragraph 61 and Figures 2-3).

Heuscher et al. fails to explicitly disclose the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position.

Sourbelle performing the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Pan et al. to include the spiral tangent filtering of Sourbelle, since a person would have been motivated to imaging by improving image quality (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1) as taught by Sourbelle.

Note: Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

With respect to claim 3, Heuscher et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation (Figures 1-3, cone-beam), and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation, are weighted to a relatively greater extent than the rays arranged

close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Figure 2).

With respect to claim 4, Heuscher et al. further discloses the rebinning includes,

converting, before filtering, the initial data obtained in fan beam geometry in the form of rays P(α,β, q) into parallel data present in parallel beam geometry in the form of rays P(θ, β, q) or P(θ, p, q), where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

θ = α + β is the parallel fan angle,

p = $R_F$sin (β) is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Abstract, wedge rebinning).

With respect to claim 5, Heuscher et al. further discloses the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each θ.epsilon.[o,π] for the rays P(θ +kπ, $\tilde{\beta}$, q) and P(θ +kπ, $\bar{\beta}$, q) whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\theta) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{\beta} \\ \beta \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{\beta} \\ \beta \end{Bmatrix}, q\right)$$ is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{p}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Steps of Figure 1).

With respect to claim 12, Heuscher et al. further discloses the focal path is a spiral path which is brought about by the focus being moved about the system axis on a circular path and, at the same time, a relative movement between focus and object under examination in the direction of the system axis taking place (Paragraph 1).

With respect to claim 14, Heuscher et al. discloses a Computed Tomography (CT) device for scanning an object under examination (Figure 1), comprising:

means for scanning the object, including at least one focus from which a beam originates (Figure 1);

a detector array including a plurality of distributed detector elements arranged in rows and lines, wherein the at least one focus is movable relative to the object on at least one focal path running around the object and wherein the detector array is adapted to supply detected data representing an attenuation of the rays passing through the object (Figure 1), the detected data configured to be obtained in fan beam geometry and rebinned into parallel beam geometry (Paragraph 39);

means for filtering the detected data (Paragraph 40), the means for filtering (Figure 1);

means for backprojecting the filtered data, three-dimensionally (Abstract, Paragraph 50 and Figure 1, wedge method used and voxels produced), to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer (slices produced), wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Paragraph 61 and Figures 2-3); and

means for collecting the data (Figure 1).

Heuscher et al. fails to explicitly disclose carryout filtering in a direction of a tangent to the at least one focal path (helical) belonging to the respective focal position.

Sourbelle carryout filtering in a direction of a tangent to the at least one focal path (helical) belonging to the respective focal position (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Heuscher et al. to include the spiral tangent filtering of Sourbelle, since a person would have been motivated to imaging by improving image quality (Page 33, lines 6 – 26, Page 73, Summary and Figure 5.1) as taught by Sourbelle.

Note: Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

With respect to claim 15, Heuscher et al. further discloses at least one of the means for scanning, the means for filtering and the means for backprojecting is at least partly implemented by at least one of programs and program modules (Figure 1, computer is necessarily programmed).

With respect to claim 16, Heuscher et al. further discloses the beam includes an extent in the direction of rotation and an extent in the direction of the axis of rotation, and wherein arranged centrally in the beam, as based on the extent of the beam in the direction of the axis of rotation, are weighted to a relatively greater extent than the rays arranged close to the edge in the beam, as based on the extent of the beam in the direction of the axis of rotation (Figures 2-4).

With respect to claim 18, Heuscher et al. further discloses the detector array includes detector elements arranged in the manner of rows, and the weighting function represents a function of the row number W(q) (Figures 2-4).

With respect to claim 19, Heuscher et al. further discloses the detector elements on the detector array are arranged distributed in the manner of a matrix (Figures 1-4).

With respect to claim 21, Heuscher et al. further discloses an apparatus operable to perform the method of claim 1 (Figure 1).

With respect to claim 22, Heuscher et al. further discloses the apparatus includes a Computed Tomography (CT) scanner (Figure 1).

With respect to claim 24, Heuscher et al. further discloses a Computed Tomography (CT) device operable to perform the method of claim 1 (Figure 1).

14. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heuscher et al. claim 5 above, and further in view of Bruder et al.

With respect to claim 6, Heuscher et al. as modified above suggests the method as recited above.

Heuscher et al. fails to explicitly disclose during the backprojection of the parallel data,

the normalized weights and normalized projections are formed.

Heuscher et al. discloses during the backprojection of the parallel data, the normalized weights and normalized projections are formed (Equations 2 and 3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Heuscher et al. as modified above the normalizing of Proksa et al., since person would have been motivated to make such a modification to improve imaging by appropriately considering the contribution of each ray of each projection makes to the backprojection (Page 543, lines 29-30) as implied by Bruder et al.

With respect to claim 17, Heuscher et al. further discloses the weighting function represents a function of the parallel fan angle with $W(\theta + k\pi)$ (Paragraph 39 and Figure 2).

15. Claims 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heuscher et al. and Sourbelle as applied to claim 1 above, and further in view of Hsieh.

With respect to claim 20, Heuscher et al. as modified above suggests the method as recited above.

Heuscher et al. fails to explicitly disclose a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method.

Hsieh teaches a computer-readable medium comprising computer executable instructions configured to cause a computer to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to include in the method of Heuscher et al. as modified above the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

With respect to claim 23, Heuscher et al. as modified above suggests the method as recited above.

Heuscher et al. fails to explicitly disclose a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform a method.

Hsieh teaches a computer-readable medium having code portions embodied thereon that, when read by a processor, cause said processor to perform a method (Col. 8, line 57 - Col. 9, line 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Heuscher et al. as modified above the computer readable medium of Hsieh, since person would have been motivated to make such a modification to improve imaging by more easily updating existing systems to implement the invention (Col. 8, line 66 - Col. 9, line 1) as taught by Hsieh.

Double Patenting

16. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or

improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

17. Claims 1, 4-6, 12, 19, 21-22 and 24 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,839,400 B2 in view of Tuy ('755).

With respect to claim 1, U.S. Patent No. 6,839,400 B2 claims a method of creating images in computed tomography, comprising:

rotating at least one focus, to scan an object under examination with a beam originating from the at least one focus, relative to the object on at least one focal path running around the object, wherein a detector array including a plurality of distributed detector elements arranged in rows and lines and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination;

filtering the initial data, and the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position;

backprojecting the filtered initial data, three-dimensionally, to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object (Claims 1, 5 and 11).

U.S. Patent No. 6,839,400 B2 fails to claim, wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry and, wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows.

Tuy teaches, wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (52) and, wherein, during the backprojection, the rays are weighted (56 and Figure 1) as a function of corresponding position

in the beam with a weighting function (Col. 2, lines 42-48 and Col. 8, lines 12 -13, multiplicity function which is introduced to account for redundancy in the collected data. Also see patent application number 09/164,013 corresponding to US patent number 6,097,784, hence referred to as Tuy (‘784), where multiplicity function has terms corresponding to relative level to the point of reconstruction, i.e. cone angle in beam) representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Col. 14, lines 44-64 and claim 9 of Tuy (‘784) where weight of 1 applied when vertex, source point, is at same level as reconstruction point and goes to zero as vertex rotates helically. So when cone angle zero, point to reconstruct at center of detector and weight is one. As source rotates, cone angle increases and weight goes to zero gradually, hence a smooth function.).

It would have been obvious to one of ordinary skill in the art at the time the invention was claimed to modify the claims of U.S. Patent No. 6,839,400 B2 to include the method of rebinning of Tuy, since a person would have been motivated to make such a modification to improve computational efficiency and reduce complexity by performing a parallel rebinning of the data (Col. 1, line 58 – Col. 2, line 3) as taught by Tuy.

It would have been obvious to one of ordinary skill in the art at the time the invention was claimed to modify the claims of U.S. Patent No. 6,839,400 B2 to include the method of smooth function of Tuy, since a person would have been motivated to make such a modification to improve account for the redundancy in the collected data (Col., lines 112-13) as taught by Tuy.

With respect to claim 4, U.S. Patent No. 6,839,400 B2 further claims converting, before filtering, the initial data obtained in fan beam geometry in the form of rays $P(\alpha,\beta, q)$ into parallel data present in parallel beam geometry in the form of rays $P(\theta, \beta, q)$ or $P(\theta, p, q)$, where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

$\theta = \alpha + \beta$ is the parallel fan angle,

$p = R_F \sin(\beta)$ is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Claim 2).

With respect to claim 5, U.S. Patent No. 6,839,400 B2 further claims the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each θ.epsilon.$[o,\pi]$ for the rays $P(\theta + k\pi, \tilde{\beta}, q)$ and $P(\theta + k\pi, \tilde{p}, q)$ whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\theta) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)$$

is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{p}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

$\tilde{\beta}$ are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Claim 3).

With respect to claim 6, U.S. Patent No. 6,839,400 B2 further claims during the backprojection of the parallel data, the sum

$$H = \sum_{k} \sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right)$$

normalized to the sum H of the weights h

$$P_{x,y,z}(\theta) = \frac{1}{H} \sum_{k} \sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)$$

is formed (Claim 4).

With respect to claim 12, U.S. Patent No. 6,839,400 B2 further claims the focal path is a spiral path which is brought about by the focus being moved about the system axis on a circular path and, at the same time, a relative movement between focus and object under examination in the direction of the system axis taking place (Claims 7-8).

With respect to claim 19, U.S. Patent No. 6,839,400 B2 claims the detector elements on the detector array are arranged distributed in the manner of a matrix (Claim 1).

With respect to claims 21-22 and 24, U.S. Patent No. 6,839,400 B2 claims the method of claim 1 as recited above.

U.S. Patent No. 6,839,400 B2 fails to claim an apparatus operable to perform the method, where the apparatus includes a CT scanner and the CT device operable to perform the method.

Tuy teaches an apparatus operable to perform the method, where the apparatus includes a CT scanner and the CT device operable to perform the method (Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was claimed to modify the claims of U.S. Patent No. 6,839,400 B2 to include the device of Tuy, since a person would have been motivated to make such a modification to improve patient health by utilizing an apparatus in which patient scanning is conducted and on which the reconstruction method was implemented.

18. Claims 1, 4-6, 11-12 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Proksa et al. (US 6,285,733 B1) in view of Grass et al. ("3D Cone-beam CT Reconstruction for Circular Trajectories", 2000, Physics in Medicine and Biology, Volume 45, Pages 329-347).

With respect to claim 1, U.S. Patent No. 6,839,400 B2 claims a method of creating images in computed tomography, comprising:

rotating at least one focus, to scan an object under examination with a beam originating from the at least one focus, relative to the object on at least one focal path running around the object, wherein a detector array including a plurality of distributed detector elements arranged in rows and lines and the detector array is adapted to detect rays of the beam and is adapted to supply initial data representing an attenuation of the rays passing through the object under examination;

filtering the initial data, and the filtering is carried out in a direction of a tangent to the at least one focal path belonging to the respective focal position;

backprojecting the filtered initial data, three-dimensionally, to produce at least one slice of a layer of the object having a layer thickness, the slice representing radiation absorption values of voxels belonging to the layer of the object (Claims 1, 5 and 11).

U.S. Patent No. 6,839,400 B2 fails to claim, wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry and, wherein, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting

function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows.

Proksa et al. teaches wherein before the filtering, the initial data is obtained in fan beam geometry and rebinned into parallel beam geometry (Col. 5, lines 20-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was claimed to modify the claims of U.S. Patent No. 6,839,400 B2 to include the method of rebinning of Proksa et al., since a person would have been motivated to make such a modification to improve computational efficiency and reduce complexity by performing a parallel rebinning of the data as implied by Proksa et al.

Grass et al. teaches, during the backprojection, the rays are weighted as a function of corresponding position in the beam with a weighting function representing a smooth function of the row number, the weighting function having a value of one for rays to at least one centrally located detector row and tending to zero for rays to detector rows at an edge of the detector rows (Equations 6-7 and Figure 3. $\text{Cos}(\theta) = l_s/l_p$ is equal to 1 (when $l_s = l_p$ for central row and $\text{Cos}(\theta) = l_s/l_p$ is a function that is smoothly tending to zero as detector row approached edge of detector).

It would have been obvious to one of ordinary skill in the art at the time the invention was claimed to modify the claims of U.S. Patent No. 6,839,400 B2 to include the smooth function of Proksa et al., since a person would have been motivated to make such a modification to improve imaging by compensating for different path lengths through the volume (Page 333, lines 25-27) as taught by Grass et al.

With respect to claim 4, U.S. Patent No. 6,839,400 B2 claims converting, before filtering, the initial data obtained in fan beam geometry in the form of rays $P(\alpha,\beta, q)$ into parallel data present in parallel beam geometry in the form of rays $P(\theta, \beta, q)$ or $P(\theta, p, q)$, where

α is the focal angle

β is the fan angle

q is the row index of the detector system corresponding to the z coordinate,

$\theta = \alpha + \beta$ is the parallel fan angle,

$p = R_F \sin(\beta)$ is the parallel coordinate corresponding to the distance of the ray from the axis of rotation (system axis), and

R_F is the radius of the focal path (Claim 2).

With respect to claim 5, U.S. Patent No. 6,839,400 B2 claims the backprojection of the parallel data is carried out and, in the course of the backprojection for each voxel V(x, y, z), for each θ.epsilon.[o,π] for the rays $P(\theta + k\pi, \tilde{\beta}, q)$ and $P(\theta + k\pi, \tilde{p}, q)$ whose projection along the system axis goes through (x, y), the sum

$$P_{x,y,z}(\theta) = \sum_k \sum_q W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix} \tilde{p} \\ \tilde{\beta} \end{Bmatrix}, q\right)$$ is formed, where

x, y, z are the coordinates of the respective voxel V(x, y, z),

k is a whole number corresponding to the number of half revolutions of the focus included in the reconstruction,

$\tilde{p}$ are the parallel coordinates of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

are the fan angles of those rays whose projections along the system axis run through the coordinates (x, y) of the respective voxel V(x, y, z),

h is a weighting function determining the layer thickness of the layer of the object under examination represented in the slice produced,

d is a function which is equal to the distance of the respective ray from the corresponding voxel V(x, y) or is dependent on the distance of the respective ray from the corresponding voxel V(x, y), and

W represents a weighting function which weights rays with a large parallel fan angle θ less than rays with a small parallel fan angle θ (Claim 3).

With respect to claim 6, U.S. Patent No. 6,839,400 B2 claims during the backprojection of the parallel data, the sum

$$H = \sum_{k}\sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix}\tilde{p} \\ \tilde{\beta}\end{Bmatrix}, q\right)\right)$$

normalized to the sum H of the weights h

$$P_{x,y,z}(\theta) = \frac{1}{H}\sum_{k}\sum_{q} W \cdot h\left(d_{x,y,z}\left(\theta + k\pi, \begin{Bmatrix}\tilde{p} \\ \tilde{\beta}\end{Bmatrix}, q\right)\right) \cdot P\left(\theta + k\pi, \begin{Bmatrix}\tilde{p} \\ \tilde{\beta}\end{Bmatrix}, q\right)$$

is formed (Claim 4).

With respect to claim 11, U.S. Patent No. 6,839,400 B2 claims the focal path is a circular path (Claims 6 and 12-15).

With respect to claim 12, U.S. Patent No. 6,839,400 B2 claims the focal path is a spiral path which is brought about by the focus being moved about the system axis on a circular path and, at the same time, a relative movement between focus and object under examination in the direction of the system axis taking place (Claims 7-8).

With respect to claim 19, U.S. Patent No. 6,839,400 B2 claims the detector elements on the detector array are arranged distributed in the manner of a matrix (Claim 1).

Response to Arguments

19. Applicant's arguments filed 28 September 2009 have been fully considered but they are not persuasive.

With respect to claim 10, the Applicant argues that Grass et al. does not teach a “smooth function”. The Examiner disagrees. As noted in equation 7, the weighting function $\mathrm{Cos}(\theta) = l_s/l_p$ is a “smooth function”. Therefore, the Applicant’s remarks are not persuasive and Grass et al. still applies as prior art.

With respect to claim 10, the Applicant argues that Grass et al. fail to show certain features of applicant’s invention. It is noted that the features upon which applicant relies (i.e.,

"move from a value of 1 to a value ***near*** zero") are not recited in the rejected claim(s). The claim "tending to zero" not a value ***near*** zero. The specification discloses that a $\cos^2$ function is an example of smooth function that tends to zero. As noted in the rejection above, Grass et al. discloses the weighting function $\text{Cos}(\theta) = l_s/l_p$ which is a "smooth function" which is also a function "tending to zero". Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. Therefore, the Applicant's remarks are not persuasive and Grass et al. still applies as prior art.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Stierstorfer et al. ("Segmented multiple plane reconstruction: a novel approximate reconstruction scheme for multi-slice spiral CT", 17 July 2002, Physics in Medicine and Biology, Volume 47, Pages 2571-2581) discloses a two dimension back projection method which can be extended to a three dimensional back projection method where the filtering is performed along a spiral tangent of parallel rebinned data (entire document).

Stierstorfer et al. ("Weighted FBP – a simple approximate 3D FBP algorithm for multislice spiral CT with good dose usage for arbitrary pitch", 19 May 2004, Physics in Medicine and Biology, Volume 49, Pages 2209-2218) discloses the claimed invention (Equations 11-16 and Figure 6).

Yan et al. (“Cone beam tomography with circular, elliptical and spiral orbits”, 1992, Physics in Medicine and Biology, Volume 37, Number 3, Pages 493-506) discloses tangential filtering in the focal path direction to include spiral orbits (Abstract and Figures 1 and 3).

Manzke et al. (“Extended Cardiac Reconstruction (ECR): A helical cardiac cone beam reconstruction method”, 4 July 2003, Proceedings of the VIIth International Conference on Fully 3D Reconstruction in Radiology and Nuclear Medicine) disclosed illumination weighting of parallel rebinned data (Figure 1 and Equations 12 and 14).

21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN M. CORBETT whose telephone number is (571)272-8284. The examiner can normally be reached on M-F 8 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. M. C./
Examiner, Art Unit 2882

/Edward J Glick/
Supervisory Patent Examiner, Art Unit 2882